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ABSTRACTS OF PUBLISHED ARTICLES

UDC 669.14.018.293:669.187.26

Influence of barium-containing microcrystalline modifiers on high quality shipbuilding steel. Milyuts V. G., Tsukanov V. V., Levagin E. Yu., Golubtsov V. A. – Voprosy Materialovedeniya, 2014, N 1(77), p. 5–10.

The influence of high-strength shipbuilding steel treatment with microcrystalline modifiers containing rare-earth metals, calcium and barium on its quality has been researched. It has been established that microcrystalline modifiers provide high quality metal and increase of the barium proportion in the composition improves steel viscosity and ductility in the Z-direction.

Keywords: high-strength shipbuilding steel, out-of-furnace treatment, microcrystalline modifiers, calcium, barium, rare earth metals, steel quality, mechanical properties.

UDC 669.15–194.5:539.389.1

Yield strength research of ferritic-martensitic steel with the help of neural network and principal component analysis. Rachkov V. I., Belomytsev M. Yu., Konobeev Yu. V., Obratsov S. M., Pyshin I. V. – Voprosy Materialovedeniya, 2014, N 1(77), p. 11–19.

The neural network model of yield strength of 12% Cr ferritic-martensitic steels as a function of the test temperature and chemical composition has been developed and verified. The experimental data investigation by means of principal component analysis allowed estimating the influence of alloying elements on the strength properties.

Keywords: ferritic-martensitic steel, yield strength, simulation, artificial neural network, principal component analysis, linear regression.

UDC 669.14.018.294.2:621.785.6

Plasma hardening of rail steel. Ananyev S. P., Shur V. Ya., Chezganov D. S., Korotkov V. A. – Voprosy Materialovedeniya, 2014, N 1(77), p. 20–28.

Microhardness, structure and phase composition of plasma hardening' layer obtained on rail steel by UDGZ-200 (УДГЗ-200) have been investigated.

Keywords: plasma hardening, rail steel, optical and electron microscopes, structure and phase composition.

UDC 620.186:669.15–194.52

Atomic force microscopy for research of ferritic-perlitic steels microstructure. Syromyatnikova A. S., Gulyaeva E. M., Popov V. I. – Voprosy Materialovedeniya, 2014, N 1(77), p. 29–34.

The method of atomic force microscopy (AFM) has been applied for research of microstructure of 09G2S pipe steel (09Г2С). Samples were taken from the emergency stock and from the main gas pipeline of the Republic of Sakha (Yakutia) after long-term performance. The paper formulates requirements to samples preparation procedure, defines the list of numerical characteristics of the microstructure calculated on AFM images in addition to optical microscopy. The received results are coordinated with those of microstructure and dislocation substructure of the same metals obtained with other methods of microscopy. It is shown, that AFM is a unique method of quantitative definition of phase components roughness, characteristics of grains borders and structure regularity of perlite and could be used for estimation of material degradation degree at long service.

Keywords: ferritic-perlitic steel, atomic force microscopy, main pipeline, long-term performance.

UDC 669.131.6:621.785.6

Superficial hardening of ferrite-perlite gray cast iron with molybdenum oxide. Gurevich Yu. G. – Voprosy Materialovedeniya, 2014, N 1(77), p. 35–39.

The technology of superficial hardening of ferrite-perlite gray cast iron by preliminary oxidation of its basis with molybdenum oxide and subsequent hardening has been developed. The paper shows that hardness of oxidized cast iron after hardening exceeds hardness of malleable cast iron after hardening.

Keywords: gray cast iron, superficial hardening, surface oxidation, molybdenum oxide, tempering.

UDC 669.187.56:669.15'296–194

On the zirconium alloys produced of baddeleyite concentrate by electroslag remelting. Babenko E. G., Verkhoturov A. D., Kuzmichev E. N. – *Voprosy Materialovedeniya*, 2014, N 1(77), p. 40–46.

The paper gives experimental research results on the zirconium alloys production by electroslag remelting of low carbon steel with ceramic flux of baddeleyite concentrate originated from mineral deposits in the Russian Far East. The new methodological scheme of functional materials manufacturing on the basis of principles of a sustainable development for the territory has been offered. It has been proved that the baddeleyite concentrate could be used for getting zirconium alloys by electroslag remelting.–The hypothesis has been confirmed that the amount of reducing agent can influence on the reduction of zirconium and its transition to remelted metal. Dependences of zirconium transition through a slag bath to low carbon steel have been established. The alloys with 3 wt.% of zirconium have been obtained.

Keywords: baddeleyite concentrate, mineral deposits in the Russian Far East, zirconium steel, electroslag remelting.

UDC 669.296:621.793.16

On the evolution of wave structure between metal/oxide interface during the oxidation of zirconium alloys. Likhansky V. V., Kolesnik M. Yu. – *Voprosy Materialovedeniya*, 2014, N 1 (77), p. 47–55.

The paper determines the conditions for the evolution of periodic structures parameters at the oxide / metal boundary on the basis of minimizing principle of mechanical stresses energy in oxide films and zirconium. It is shown that the doubling effect may lead to wavelength increase of the interface between the oxide and the metal at the oxide film growth.

Keywords: zirconium alloys, oxide films, mechanical stress, evolution of the periodic structures parameters.

UDC 669.35'5:539.421

Research of damage character and destruction reasons for ring blanks made of 58Cu–34Zn–3Mn–2Al alloy after hot forming. Pugacheva N. B., Trushina E. B., Antenorova N. P., Ovchinnikov A. S., Lebed A. V. – *Voprosy Materialovedeniya*, 2014, N 1(77), p. 56–64.

The paper investigates the destruction surface and microstructure of ring blanks made of 58Cu–34Zn–3Mn–2Al alloy after hot stamping. It is established that the reason of cracking consists in excessively high temperature of heating before the stamping, which leads to abnormal growth of β -grains and to borders weakening. Decrease in temperature to 700°C allows reducing significantly the cracking tendency and preserving moulds capacity.

Keywords: brass, microstructure, α -phase, β -phase, silicide, synchronizer blocking ring, damage, fractography.

UDC 621.891:621.793.74

Antifriction properties of plasma oxide coatings on titanium alloys paired with graphite and babbitt material. Ivanov V. G., Korkosh S. V. – *Voprosy Materialovedeniya*, 2014, N 1 (77), p. 65–72.

The paper studies tribological properties of the antifriction coating produced by plasma spraying of powder mixture consisting of Al_2O_3 (as electrocorundum) and 13–40% of titanium oxide.

Keywords: titanium alloy, plasma coating, powder mixture spraying, antifriction properties.

UDC 621.762.34:621.793.74

Plasma-chemical synthesis of nanoscale aluminum oxide powders and their use as a reinforcing components in the microplasma spraying. Bobkova T. I., Bystrov R. Yu., Farmakovskiy B. V. Astashov A. G., Sinaiskiy M. A. – Voprosy Materialovedeniya, 2014, N 1 (77), p. 73–78.

The paper studies the process of synthesis in the plasma-chemical reactor of nano aluminum oxide using disperse aluminum as a raw material. A method of using plasma-chemical powders as reinforcing components for composite powder material for microplasma spraying has been proposed. The coatings obtained on the basis of traditional and novel composite powder materials have been researched.

Keywords: aluminum oxide, nanopowders, plasma-chemical synthesis, spraying of coatings.

UDC 621.9.048.7:621.793.16

Investigation of the phase composition of the metall alloy surface after pulse laser radiation. Ganzulenko O. Yu. – Voprosy Materialovedeniya, 2014, N 1(77), p. 79–86.

The article has been devoted to the study of the morphology and phase composition of the oxide film layers originated by pulsed laser radiation on the surface of metallic materials. The results of X-ray diffraction analysis and analysis of the structure and composition of the surface and near-surface layers using ion etching have been recommended for choosing temperature – time modes, directly related to the parameters of the marking laser system to produce oxide films of the defined colors.

Keywords: laser radiation, color shades, oxide films, X-ray analysis, phase composition.

UDC 621.793.71:621.762

Study of the flow temperature in the cold gas-dynamic spraying of the functional coatings. Gerashchenkov D. A., Vasiliev, A. F., Farmakovskiy B. V., Mashek A. Ch. – Voprosy Materialo-vedeniya, 2014, N 1 (77), p. 87–96.

The paper proposes a calibration method for infrared radiometers used in the technological process of cold gas dynamic spraying, which made possible the measurement of the temperature of the powder particles on the basis of aluminum and iron. It is shown that the particles temperature in the gas stream and stagnation temperature of 500–600°C does not exceed 40°C values for aluminum powder and 80°C for steel powder.

Keywords: functional coatings, cold gas dynamic spraying, infrared radiometer, calibration method, stagnation temperature.

UDC 621.318.12:621.762.34

Features of mechanochemical alloying of hard magnetic materials with samarium. Popovich A. A., Verevkin A. S., Razumov N. G., Popovich T. A. – Voprosy Materialovedeniya, 2014, N 1(77), p. 97–102.

The paper researches the effect of mechanical activation and nitriding time on the structure and properties of Sm–Fe–N alloys. The influence of alloying elements (nitrogen, titanium, molybdenum) on Curie temperature the magnetic properties of the resulting alloys has been studied. It has been revealed that the introduction of the alloying elements results in homogeneous structure and uniform distribution of particles, leads to magnetic properties improvement (lattice distortion?) and Curie temperature increase (up to 550–560°C).

Keywords: mechanochemical synthesis, magnetic material, hard magnetic material, mechanical activation, Sm–Fe system

UDC 621.793.6:621.762.5

Structure and properties of multicomponent diffusion coatings of Ti–Fe–B–C on sintered steels. Bagliuk G. A., Uskova N. A., Mamonova A. A., Bezdorozhev A. V., Tikhonova I. B. – Voprosy Materialovedeniya, 2014, N 1(77), p. 103–108.

The results of investigation of the structure and phase composition of multicomponent diffusion coatings of Ti–Fe–B–C, obtained by diffusion saturation combined with sintering of porous compacts from iron and graphite powder mixtures with use of different compositions saturating mixtures are presented. It is shown that insertion of carbon to the initial powder mixture increases the diffusion layer thickness, its density and hardness. Coating thickness somewhat increases application in the saturating mixture of activation agent containing borax, ammonium chloride and sodium chloride, as compared to aluminum

fluoride. The predominant phase in the coatings obtained at 1100°C for steel with a low carbon content is iron boride FeB, whereas with an increase of sintering temperature to 1150°C and graphite content in the initial powder mixture up to 1.5 % the TiB₂ and TiC phases with higher hard level become predominant in the coating structure.

Keywords: diffusion coating, activating agent, boride, carbide, phase composition, saturation, titanium, boron, carbon, surface hardening.

UDC 678.664:621.822.6

Detrition of solid polyurethane tires under rolling with slip. Yakovlev S. N. – Voprosy Materialovedeniya, 2014, N 1(77), p. 109–115.

Empirical equation for determination of wear rate of polyurethane with different hardness under rolling with slip is presented. Detailed model of detrition of solid tire elastic rim in contact with hard surface is given.

Key words: experimental plant, detrition of polyurethane rim, normalized abrasive surface, cyclic wear intensity, cement – concrete surface.

UDC 678.067.2

Carbon plastics on the basis of imported carbon fabrics and Russian binders. Gulyaev I. N., Zelenina I. V., Raskutin A. E. – Voprosy Materialovedeniya, 2014, N 1(77), p. 116–125.

The paper shows characteristics of carbon composites on the basis of carbon fabrics produced by “Porcher” company using domestic binders developed by FSUE “VIAM”. Comparison of the developed carbon composites and carbon composites on the basis of domestic carbon fillers has been given. Recommendations for their application have been provided.

Key words: carbon plastics, binding, carbon fabrics.